

A Case Study of an Outbreak of Salmonellosis in Wisconsin

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2023 Alaska Food Protection Task Force Educational Workshop

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Wisconsin Department of Health Services

Outline

What is an outbreak?

How does public health detect and investigate outbreaks?

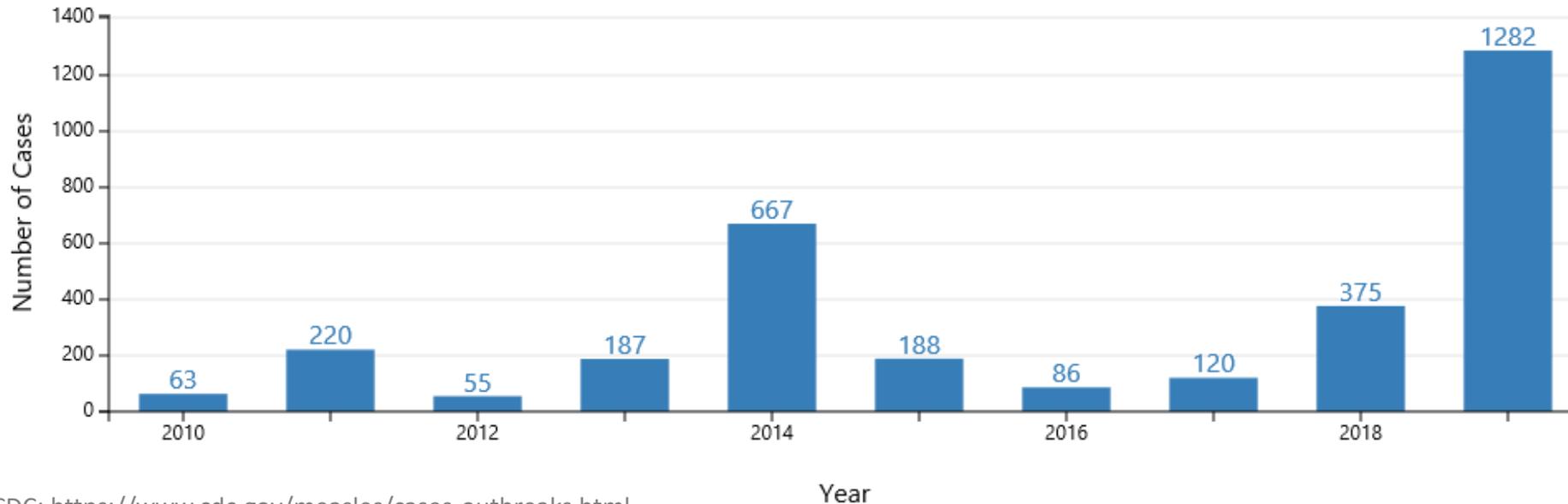
Case study of a salmonellosis outbreak investigation

Outbreak

More cases of a particular disease than expected in a given area, or among a specific group of people, over a particular period of time

Number of Measles Cases Reported by Year

2010-2019**(as of December 31, 2019)



Foodborne Outbreak



Two or more cases of a similar illness
resulting from ingestion of a common food

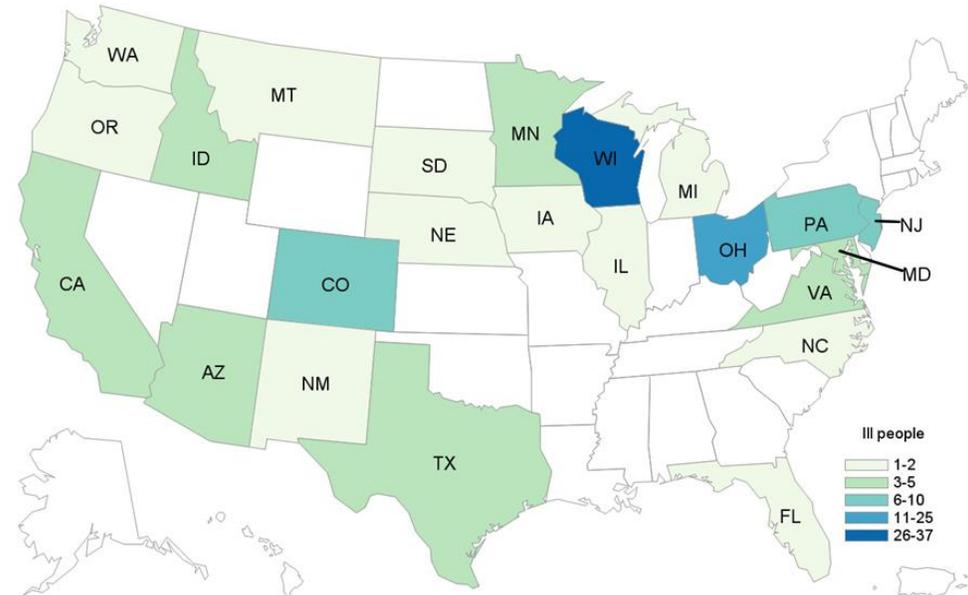
Classic local or event-related



People infected with the outbreak strain of *E. coli* O157:H7, by state of residence, as of December 2, 2019 (n=102)



Widespread or dispersed



How does public health become aware of an outbreak?



Español

[Public Health](#) / [Environmental Health](#) / [Food Safety](#) / [Foodborne Illness Reporting](#)

Foodborne Illness Reporting

How to Report a Foodborne Illness

Do you think you got sick from something you ate? Let us know by answering a few questions about your symptoms, places you've visited, and what you ate. Please use our safe, online report or call us directly at (608) 266-4821.

[FILE AN ONLINE FOODBORNE ILLNESS REPORT](#)

The information you report through this website is safe, secure and confidential.

Your report is automatically sent to Public Health Madison & Dane County, and only authorized staff can access it. Information you provide will not be shared with restaurants or any other third parties.



WEDSS Reporter

Username

Password

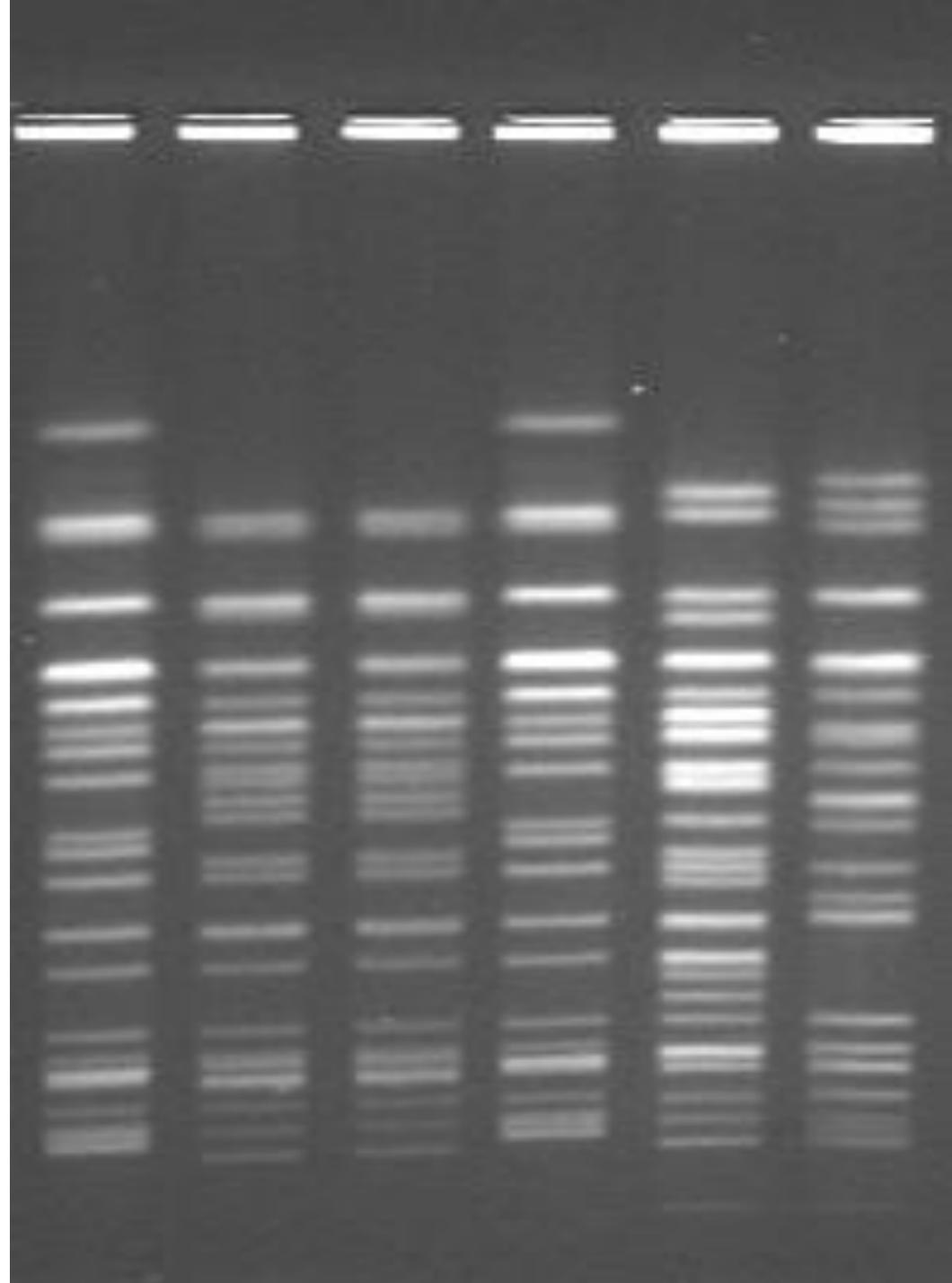
Login



Laboratory Surveillance

Can detect increases in a specific subtype or strain of a pathogen

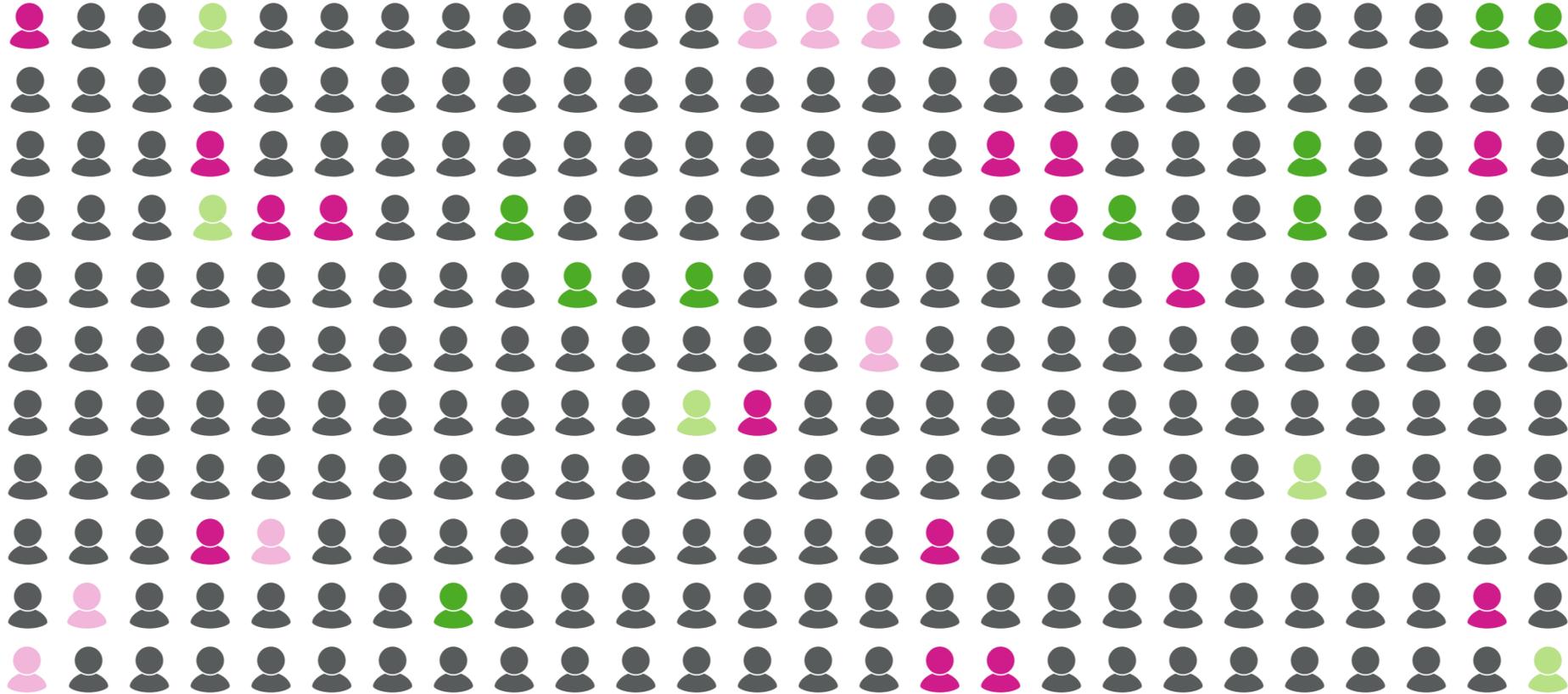
- Serotyping, speciation, genogroups
- DNA fingerprinting
- Molecular subtyping of viruses



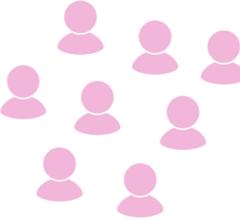
Laboratory Surveillance



Laboratory Surveillance



Laboratory Surveillance

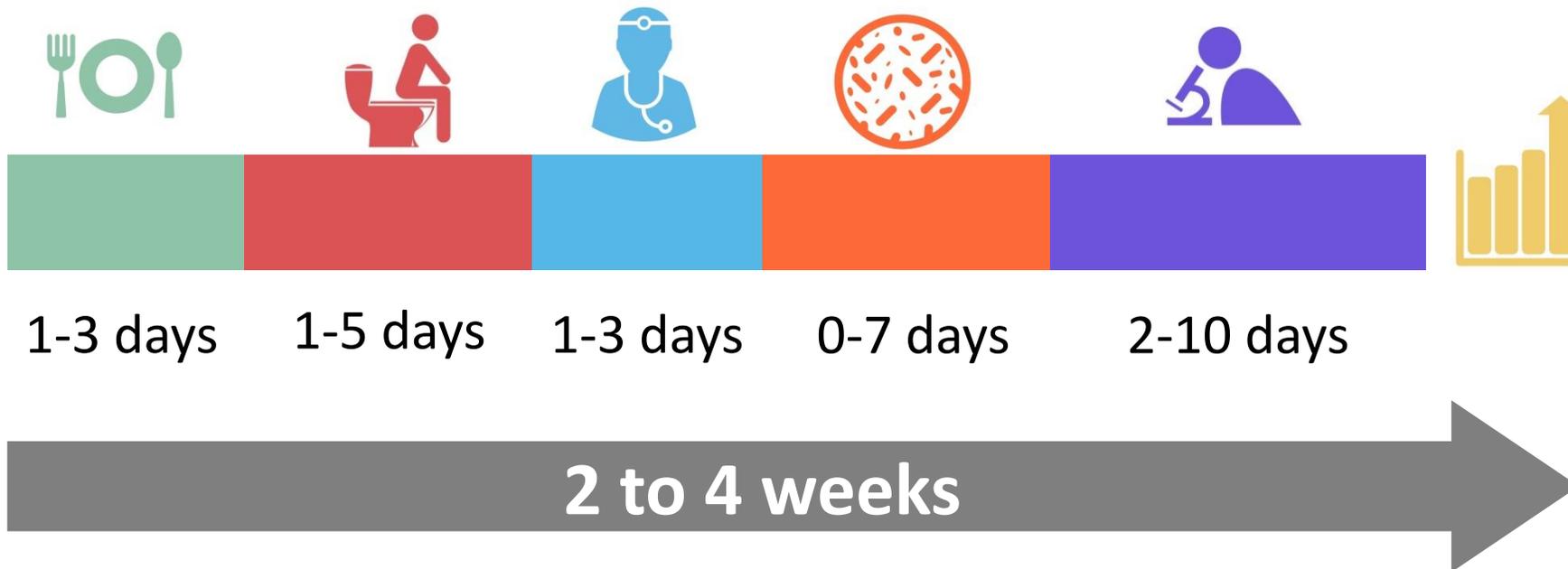


Public Health Follow-Up

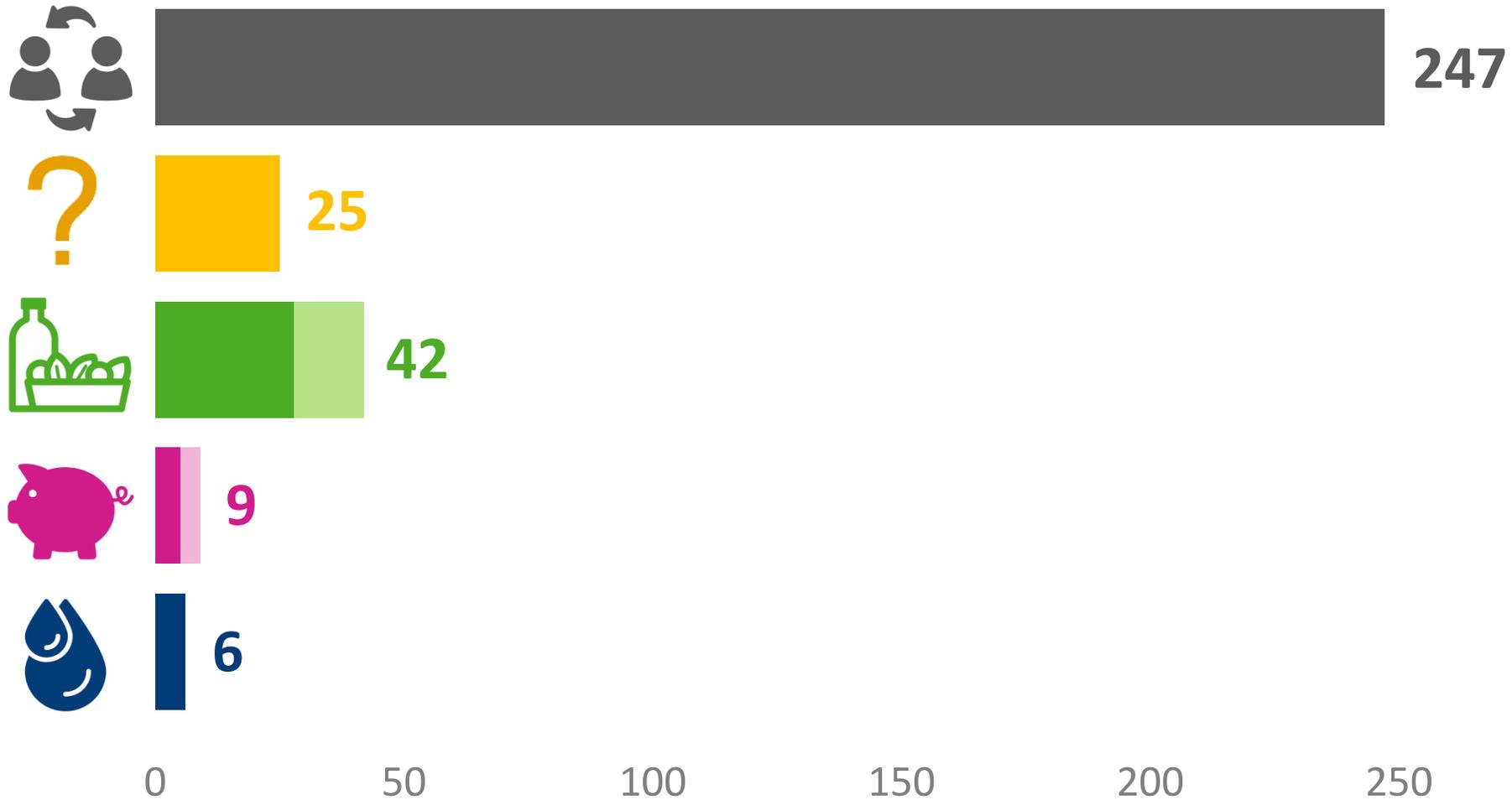
Collect exposure information to identify possible sources of infection:

- Travel
- Contact with animals
- Contact with other ill people
- Sources of food (restaurants, vendors, stores)
- Foods consumed
- Occupation

Implicated Meal to Outbreak Recognition

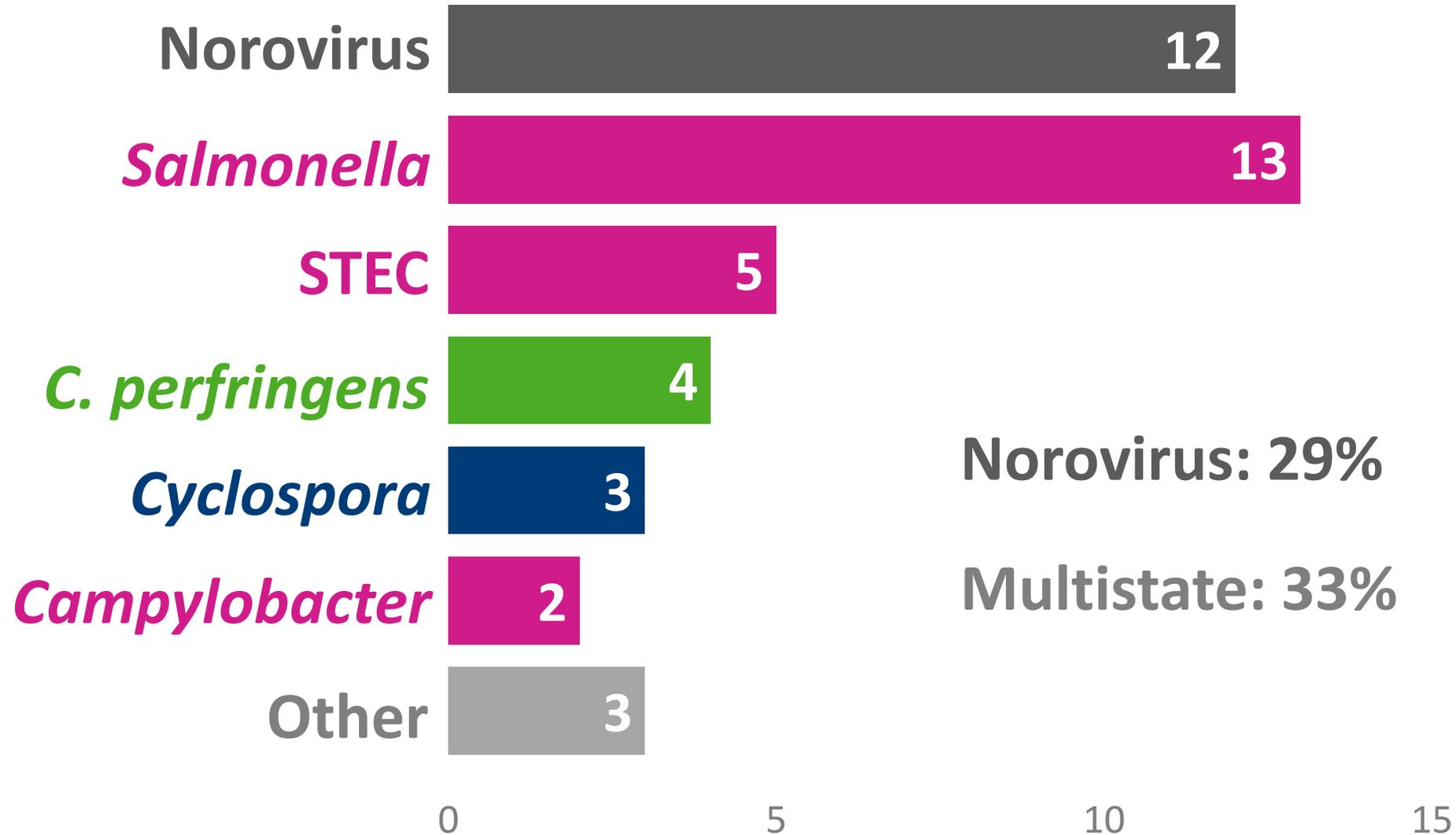


2018 Enteric or Waterborne Outbreaks, Wisconsin By Mode of Transmission

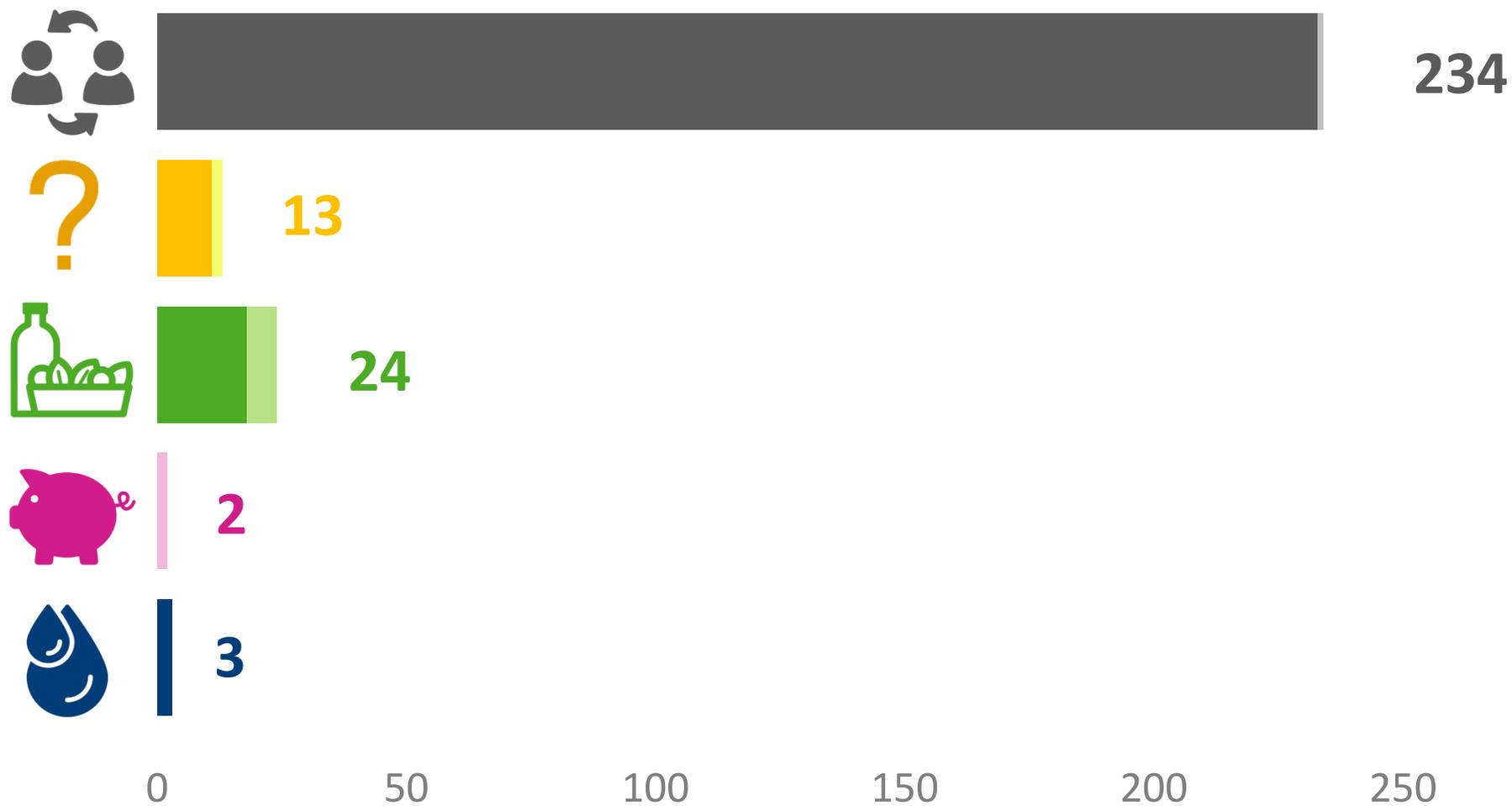


2018 Foodborne Outbreaks, Wisconsin

By Etiology

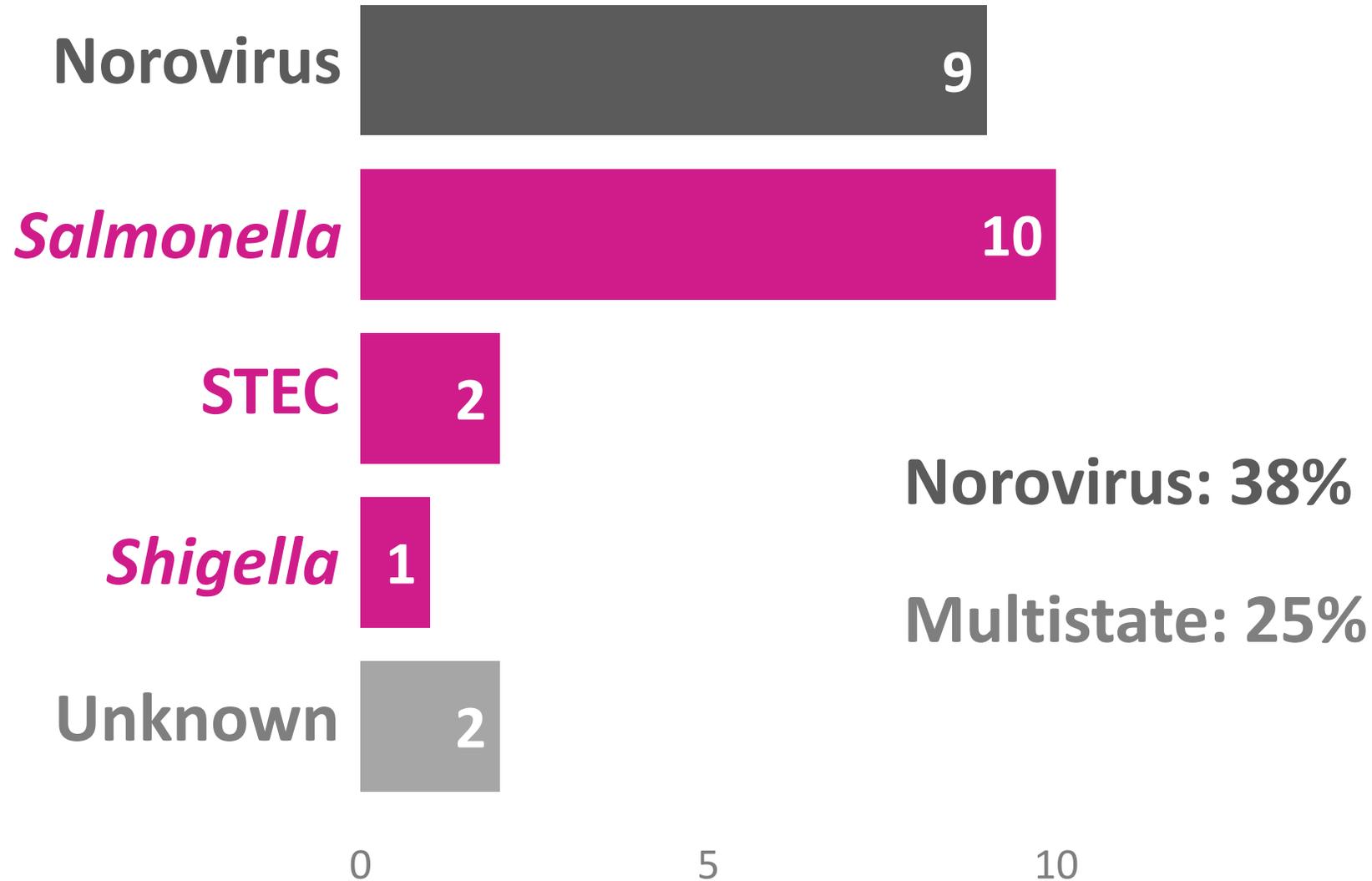


2022 Enteric or Waterborne Outbreaks, Wisconsin By Mode of Transmission



2022 Foodborne Outbreaks, Wisconsin

By Etiology



Initiation of an Outbreak Response



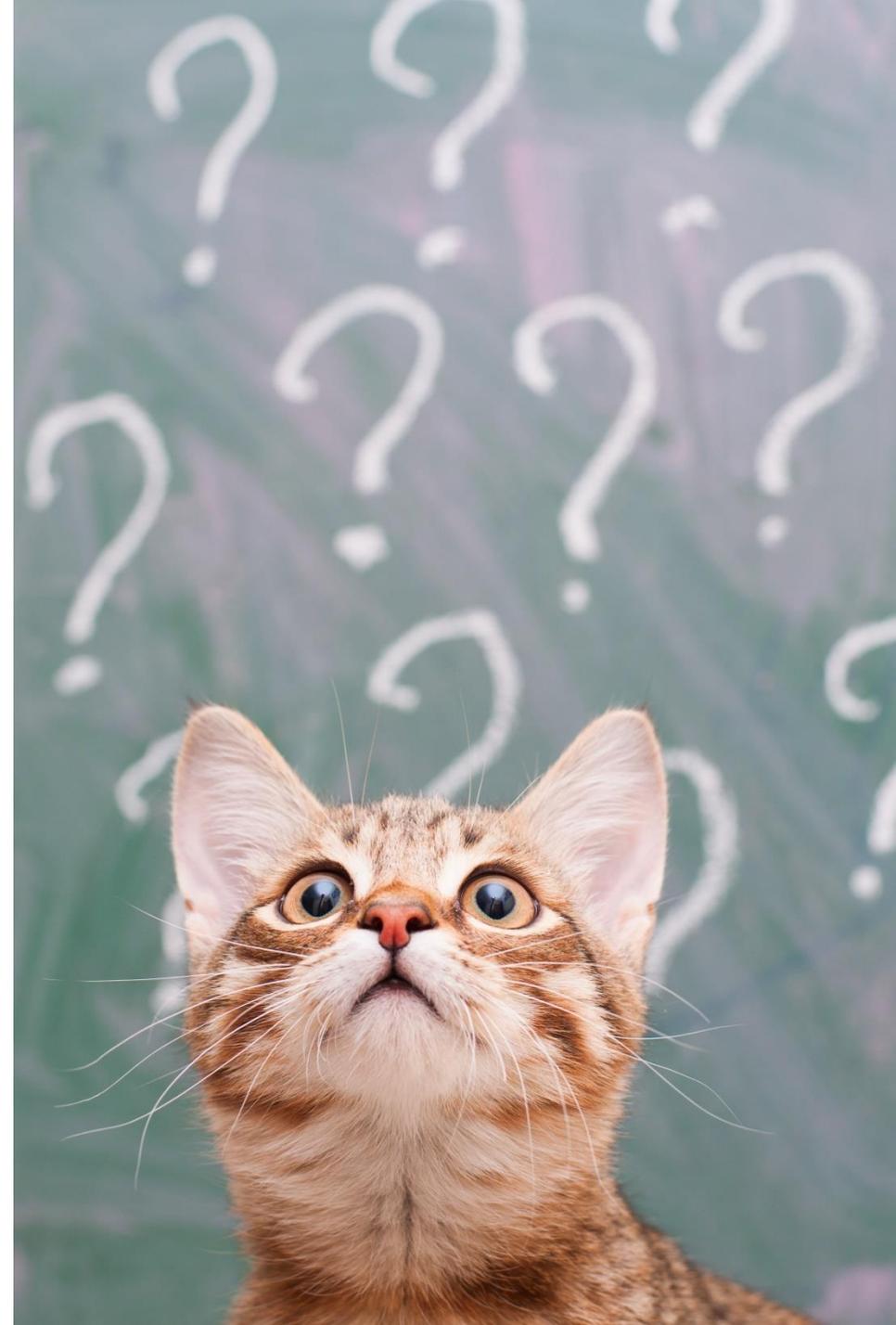
Establish Existence of an Outbreak

Do case numbers exceed baseline levels?

Is there an unusual clustering in space or time?

Is there a common source or exposure?

Could increases be an artifact?



Describe and Orient Data: Time, Place, Person

- ❑ Line list
- ❑ Epidemic curve or “epi curve”

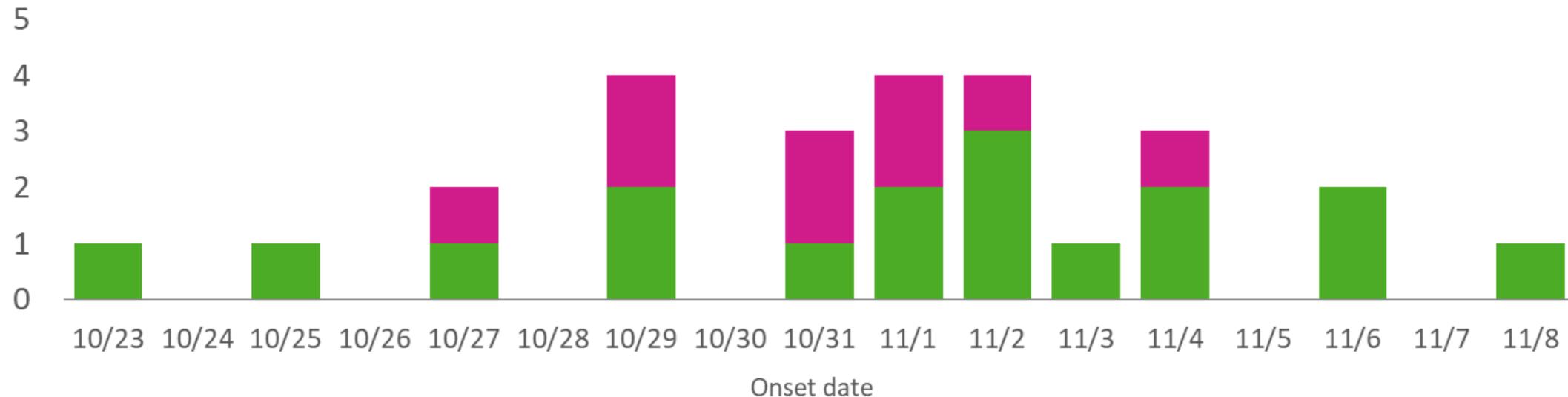


Describe and Orient Data

Epi Curve: Norovirus Outbreak Example 1

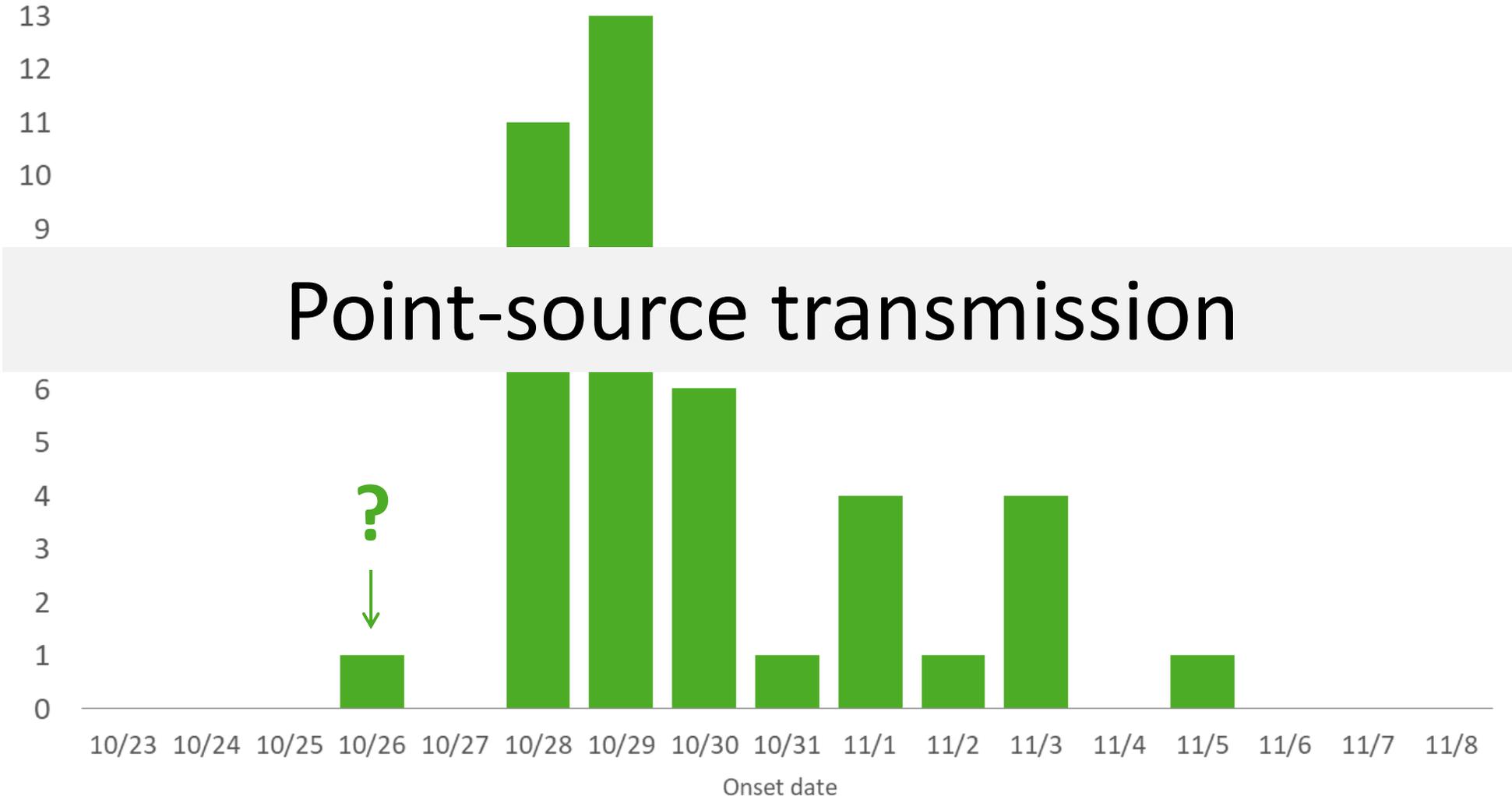


Person-to-person transmission



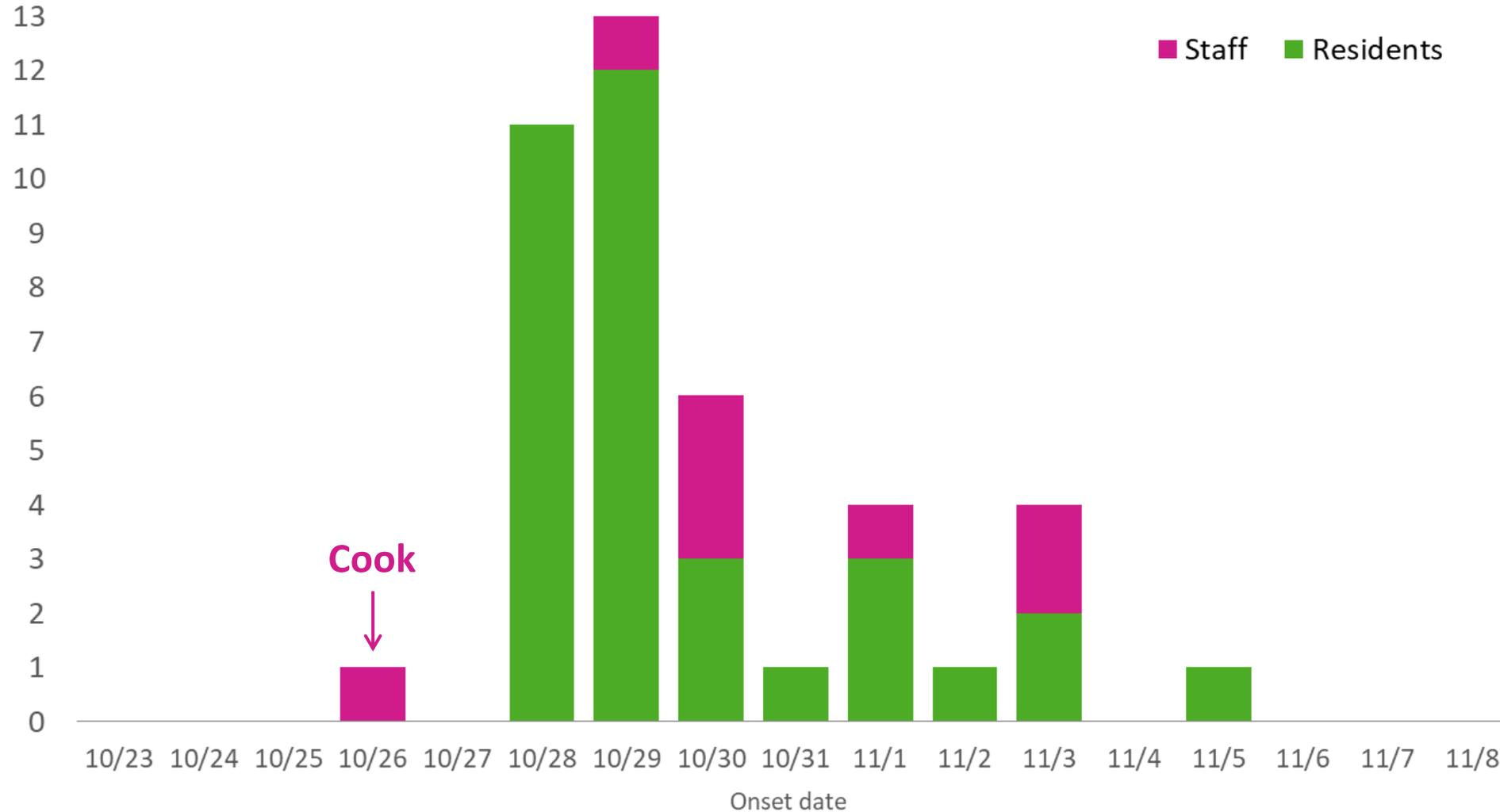
Describe and Orient Data

Epi Curve: Norovirus Outbreak Example 2

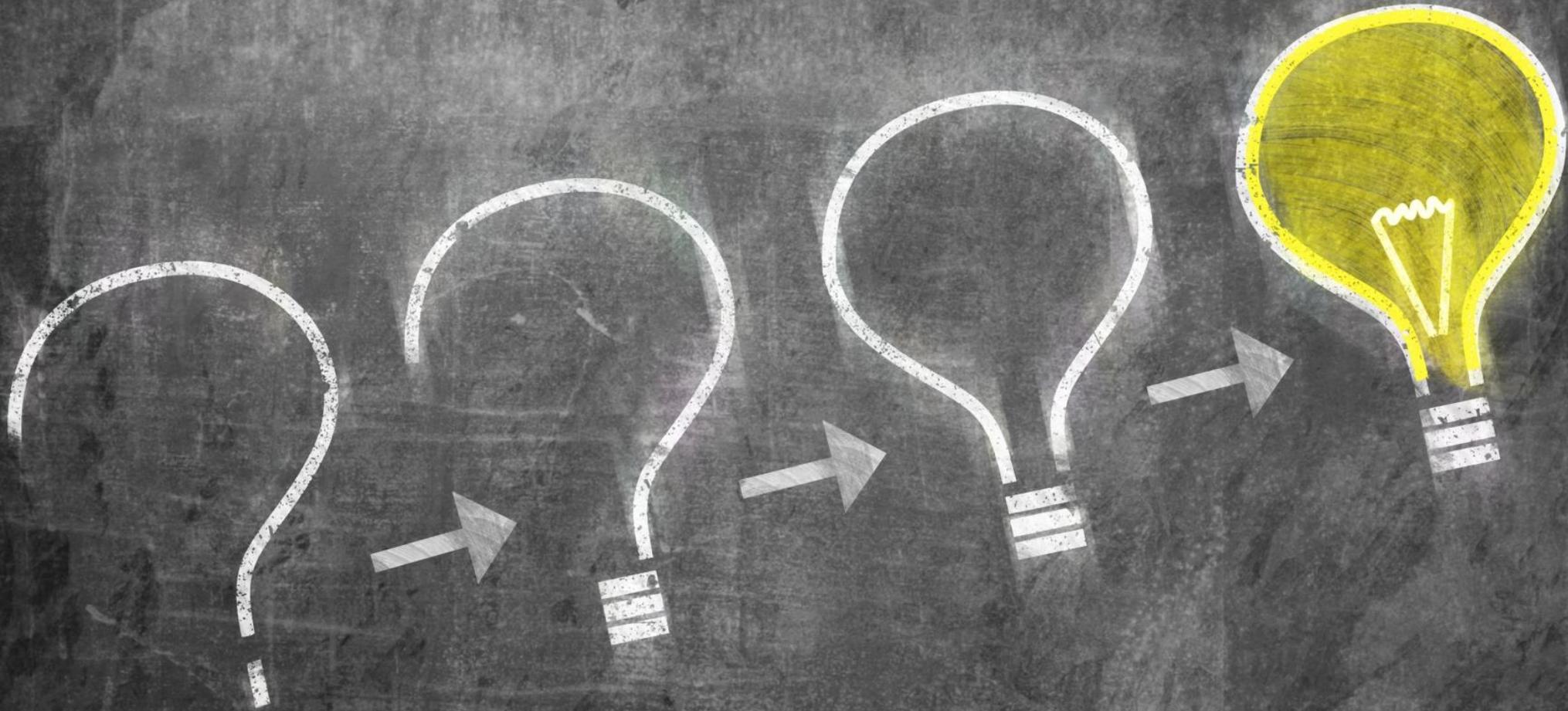


Describe and Orient Data

Epi Curve: Norovirus Outbreak Example 2



Develop, Evaluate, and Refine Hypotheses



Conduct an Analytic Study

- Help identify the vehicle, source or behavior associated with illness
- Test the hypothesis
 - Cohort study
 - Case-control study
- Collect data (interviews) from both **ill and well** individuals



No

Yes

Conduct an Analytic Study



Analytic Study: 2 x 2 Table

	Ill (Cases)	Well (Controls)
Exposed	a	b
Unexposed	c	d

Analytic Study: 2 x 2 Table

	Ill (Cases)	Well (Controls)
Exposed	a	b
Unexposed	c	d

$$\text{Odds ratio (OR)} = (a/b) / (c/d) = (a \times d) / (b \times c)$$

Analytic Study: 2 x 2 Table Example

	Ill	Well
Ate food item	20	6
Did not eat food item	1	15

Analytic Study: 2 x 2 Table Example

	Ill	Well	Attack Rate
Ate food item	20	6	77%
Did not eat food item	1	15	6%

Analytic Study: 2 x 2 Table Example

	Ill	Well
Ate food item	20	6
Did not eat food item	1	15

$$\text{OR} = (20 \times 15) / (6 \times 1) = 50.0$$

p-value < 0.001

Evaluate and Refine Hypotheses



Traceback and Testing of Suspected Source



Implement Prevention and Control Measures

- Interrupt disease transmission
 - Remove contaminated food or source of exposure
 - Restrict activities
 - Treat (vaccine, antimicrobials)
 - Require tests of cure
 - Mitigate the environment
- Identify preventable risk factors
 - Develop illness policies and train employees
 - Address contributing factors
 - Develop new food processing guidelines

Communicate Findings

- Communicate regularly with investigation team
- Communicate with the public during the outbreak
 - Develop messages as a team (most outbreaks don't require public notification)
- Summarize investigation when complete
 - Describe methods and compile results
 - Make recommendations
 - Disseminate report to all participants

Communicate with the Public

Provide clear advice
to the public on how
to protect themselves
and prevent illness.

FOR IMMEDIATE RELEASE

December 10, 2019

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Elizabeth Goodsitt, 608-266-1683

Wisconsin Health Officials Find *E. coli* O157 in Bagged Romaine Salad from Salinas Valley, California

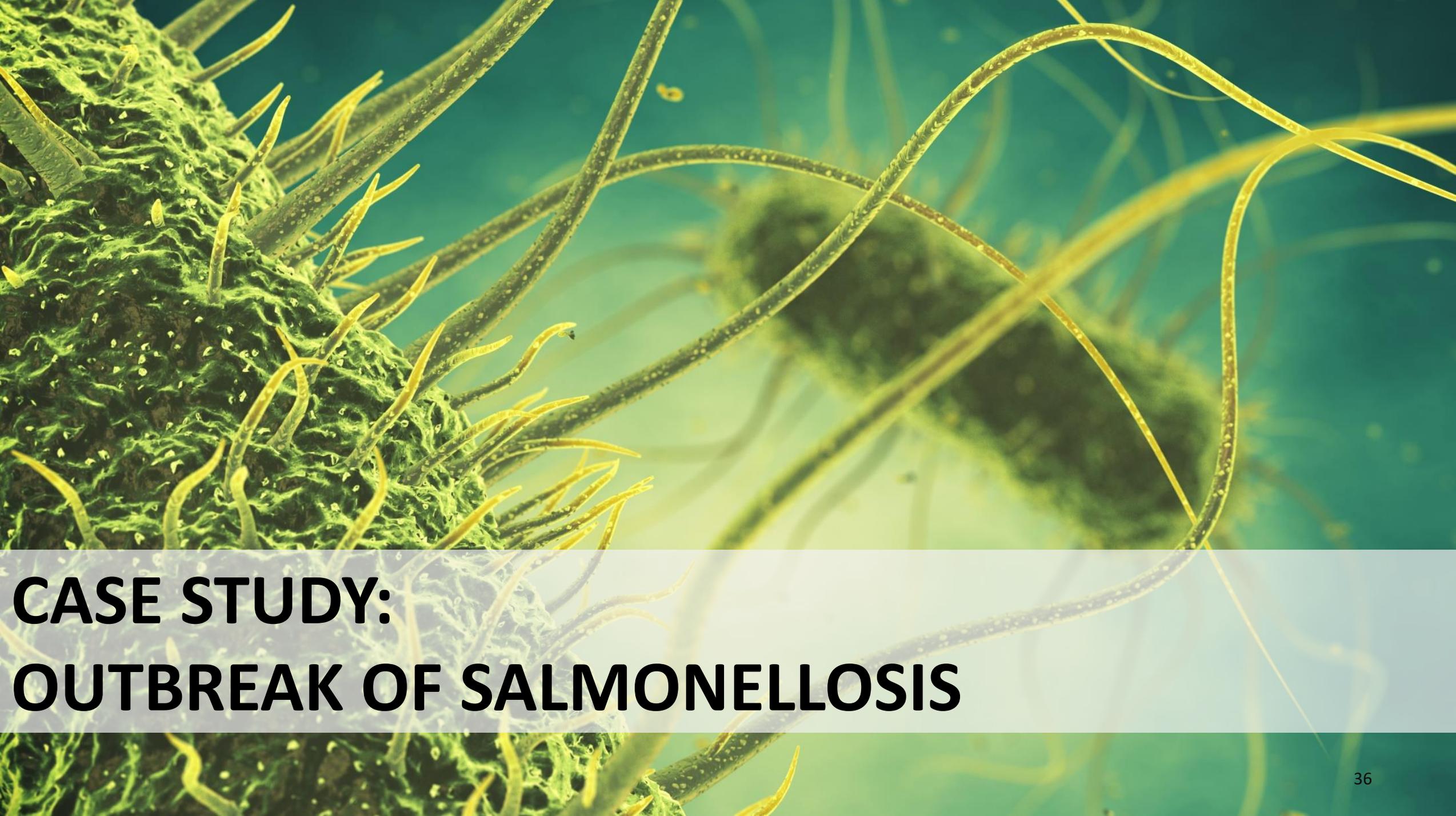
Consumers should avoid eating any products with romaine lettuce from
that region

As part of the ongoing investigation into the multistate outbreak of *Escherichia coli* O157:H7 (*E. coli* O157) infections, Wisconsin health and food safety officials have found *E. coli* O157:H7 bacteria in an unopened bag of pre-washed chopped romaine collected from an ill person's home. Additional laboratory testing is pending to determine if the *E. coli* O157 found in the pre-washed chopped romaine matches the strain causing the multi-state outbreak linked to romaine lettuce.

The *E. coli* O157 bacteria was found in a bag of chopped Fresh Express® brand Leafy Green Romaine lettuce with a use by date of 11/14/2019 and lot code of Z301 A05B. The source of the romaine identified on the packaging was Salinas Valley, California. While the bacteria was found in a bag of Fresh Express® brand romaine, it is important to note that not all ill persons in Wisconsin that are included in this outbreak have reported consuming Fresh Express® brand salads. At this time, no single product, brand, or variety of salad has been reported by all ill individuals. The investigation is ongoing to determine the source of contamination and if additional products are linked to illness.

The Wisconsin Department of Health Services (DHS) advises consumers not to consume any products containing romaine lettuce from Salinas Valley, California, regardless of brand. While **some romaine-containing products were recalled on November 21, 2019**, romaine from Salinas Valley is still available on many store shelves. It is important to look at product labels for any mention of Salinas Valley, California, and avoid purchasing these products.

DHS also advises consumers to check their refrigerators for any lettuce mixes containing romaine from the Salinas Valley and throw them away. **Produce drawers and refrigerator surfaces should be cleaned thoroughly after throwing out the product**.



**CASE STUDY:
OUTBREAK OF SALMONELLOSIS**

Outbreak Detection

November 6

Patient A diagnosed with salmonellosis was contacted by local or tribal health department (LTHD) in county A.

Patient A reported six other friends were also ill.

November						
Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Outbreak Detection

These group of friends shared a meal on **October 28** at a restaurant in County B.

Illness onset was on October 31.

October

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Outbreak Detection

Patient A could not complete the interview at the time of initial contact and then was lost to follow-up.

Public health nurse who spoke to the patient notified the LTHD in County B.

October

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Common Meal: “Murder Mystery” Dinner



Outbreak Detection

November 16

Patient B diagnosed with salmonellosis was reported to the LTHD in County B.

Illness onset was on November 1.

Patient B had a meal at the same restaurant on **October 26**.

October

Su	M	Tu	W	Th	F	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

Su	M	Tu	W	Th	F	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

What do we know about salmonellosis?

Incubation period: 12–72 hours

Duration of illness: 4–7 days

Symptoms: diarrhea, fever, and abdominal cramping

Increased risk of illness and severe outcomes among infants, older adults, and immunocompromised people

Severe illness and hospitalizations can occur.



Suspect Meal

Restaurant hosted an annual special event three times over a 3-day period: October 26, 27, 28



What did we do next?

- ✓ Review exposure information for all reported cases
- ✓ Obtain list of attendees with contact information
- ✓ Obtain list of staff and their schedules
- ✓ Obtain menu items with detailed ingredients
- ✓ Develop a detailed questionnaire
- ✓ Interview ill attendees and staff
- ✓ Interview well attendees and staff
- ✓ Perform a restaurant inspection
- ❑ Test all staff for *Salmonella*
- ❑ Shut down the restaurant

Suspect Meal

Same meal served each day

Buffet style

Craft cocktails, wine, beer



Menu

Kabobs:

chicken, beef, shrimp

Roasted vegetable medley

Crab cakes

Risotto balls

Puffed pastry with cheese and
vegetables (vol au vent)



Menu

Assortment of desserts

Craft cocktails

Raw egg whites?

Beer

Wine

Water (ice)



Outbreak Investigation Questionnaire

Separate questionnaires for patrons and employees

Section 1: Demographic information and occupation

Investigation: XXXXXXXXXX
Patient Initials: _____

Interviewer: _____
Interview Date: ____ / ____ / ____

Investigation Questionnaire (Patrons)

DEMOGRAPHIC INFORMATION

Name: _____ Age: _____ Gender: M F

Parent/Guardian Name: _____

Address: _____

City: _____ County: _____ State: _____ Zip: _____

Phone (home): _____ Phone (cell): _____

Occupation/position: _____

High risk activities: Daycare Food handler Health care provider/worker

(Provide appropriate exclusion and education if individual is ill / was ill)

Outbreak Investigation Questionnaire

Section 2: Clinical information and ill contacts

The following sections should be completed for ALL patrons:

CLINICAL INFORMATION

1. Have you been ill with gastrointestinal symptoms (diarrhea, abdominal cramping, vomiting, nausea, etc.) anytime since mid-

October? Y N *If no skip to **Other Ill Persons***

Onset Date: ___ / ___ / ___ Onset time: ___ : ___ AM/ PM

Well Date: ___ / ___ / ___ Still ill at time of interview

Nausea	Y	N	Vomiting	Y	N	Diarrhea	Y	N
						<i>(defined as 3 or more loose stools 24 hours)</i>		
Bloody diarrhea	Y	N	Abdominal cramps	Y	N	Fever (____°)	Y	N
Chills	Y	N	Sweats	Y	N	Headache	Y	N
Body aches	Y	N	Muscle aches	Y	N	Fatigue	Y	N
Other:	Y	N	_____					

Did you see a physician? Y N Date: ___ / ___ / ___

Were you seen in an ER/ED Y N Where: _____

Were you hospitalized overnight? Y N Where: _____

Was a stool specimen collected? Y N Results: _____

If no stool specimen collected, would you be willing to submit a stool specimen for free testing? Y N

Daytime contact number if different from above: _____

OTHER ILL PERSONS

2. Has anyone in your household been ill with GI symptoms since mid-October? Y N

a) If yes, who: _____ Onset date: ___ / ___ / ___ Time: ___ : ___ AM PM

What were their symptoms(circle)? Nausea / Vomiting / Diarrhea / Abd. cramps / Fever / Headache / Other: _____

Did this person consume any food from _____ before he/she became ill? Yes / No / Unk

Outbreak Investigation Questionnaire

Section 3: Exposures at the restaurant

EXPOSURES

Did you attend the “murder-mystery dinner” at [REDACTED] Restaurant? Y N

Meal date (circle): Thursday, October 26 / Friday, October 27 / Saturday, October 28

Meal time: ____ : ____ PM

4. Which of the following menu items did you consume at [REDACTED]? ***Please circle yes or no for each individual item and note any ingredient deletions or substitutions made to the item (e.g. hold the lettuce, add bacon).***

Food Item	Yes/No	Details
Served in the lounge [REDACTED]		
Risotto croquette (fried risotto balls)	Y N Unk	Any substitutions or deletions?
Crab cake with roasted red pepper sauce	Y N Unk	Any substitutions or deletions?
Vegetables vol-au-vent with goat cheese (puff pastry stuffed with cooked vegetables and cooked in the oven with cheese)	Y N Unk	Any substitutions or deletions?
Cocktail (Specify)	Y N Unk	Specify cocktail and ask whether it contained any foam/egg whites:
Wine	Y N Unk	
Beer	Y N Unk	
Any other food item(s) not mentioned? (Specify)	Y N Unk	Specify:

Outbreak Investigation Questionnaire

Section 3: Exposures at the restaurant

Dinner buffet/main course on second floor		
Grilled skewered shrimp kabobs	Y N Unk	
Grilled skewered chicken kabobs	Y N Unk	
Grilled skewered beef kabobs	Y N Unk	
Vegetable medley: potatoes, onions, peppers, zucchini	Y N Unk	Any substitutions or deletions?
Blueberry cheesecake	Y N Unk	
Chocolate cake	Y N Unk	
Apple tart	Y N Unk	
Wine	Y N Unk	
Beer	Y N Unk	
Any other food or dessert item(s) not mentioned? (Specify)	Y N Unk	Specify:

Outbreak Investigation Questionnaire

Section 4: Meal companion contact information

Do you have contact information for any of your murder-mystery dining companions?

Name	Phone	City	Ill?	Other comments
			Yes / No / Unk	
			Yes / No / Unk	

Section 5: Other activities with meal companions

5. Did you spend the night outside of your home while attending the “murder-mystery dinner”? Y N

If yes, specify location (city, (hotel name), address, street): _____

6. Since mid-October, did you share meals or participate in other activities/events with your “murder-mystery dinner” meal companions? Y N

Date of meal or activity: ____ / ____ / ____ Location: _____

Items consumed: _____

Outbreak Investigation Questionnaire

Section 6: Other exposures at the same restaurant

7. Did you dine at or order food from [REDACTED] on any other occasion since mid-October? Y N U

Date of meal: ____ / ____ / ____

Items consumed: _____

Did any of your dining companions become ill during the week after the meal? Y N U

If yes, who: _____ Symptoms: _____ Onset date: _____

ADDITIONAL COMMENTS: _____

Public Health Interviews

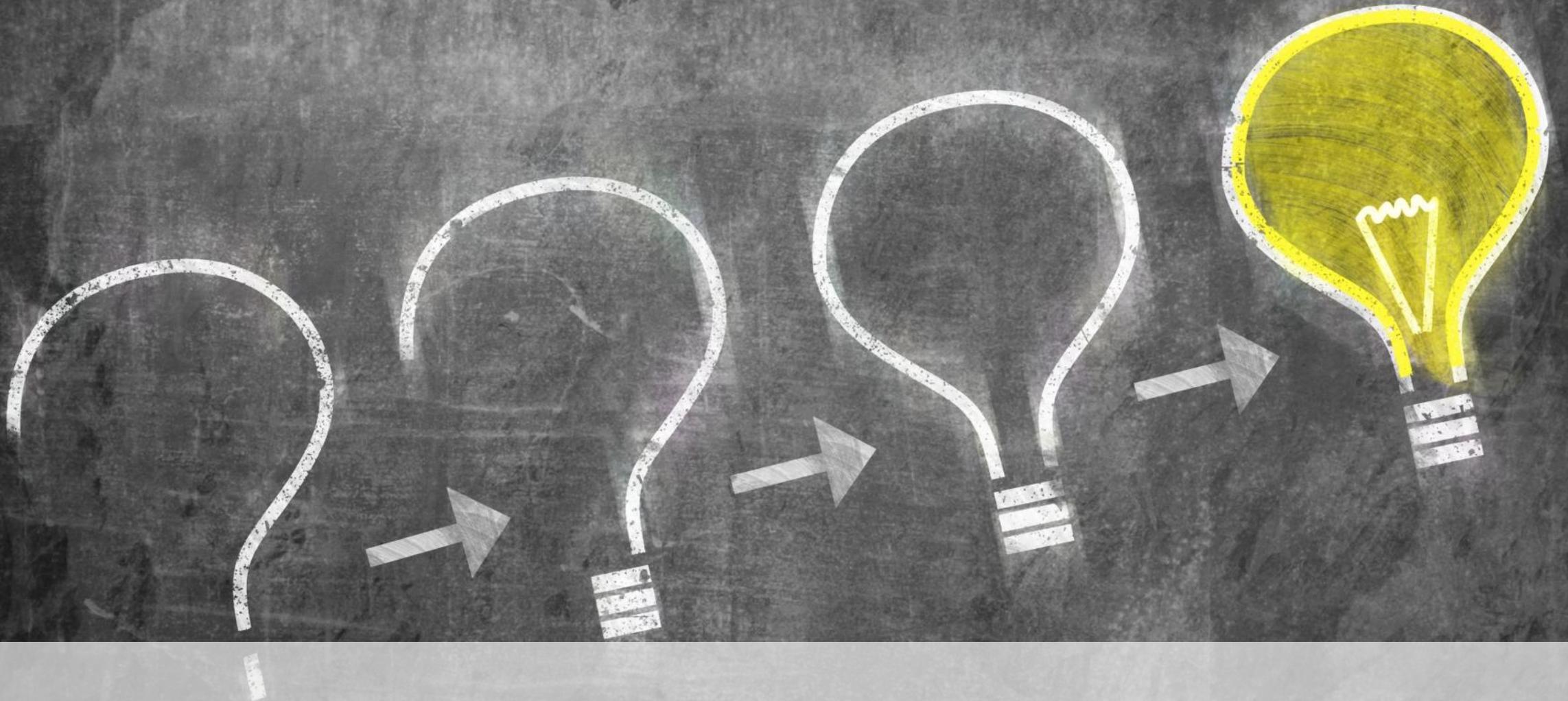
Employee interviews – LTHD environmental health specialists

Patron interviews – LTHD and DPH staff

Contact attempted with 99 patrons

Interviews completed with 52
patrons and 5 staff





OUTBREAK INVESTIGATION RESULTS

Case Summary

Interviewed 52 patrons and 5 staff

18 people had an illness that met the case definition:

- Cases linked to each of three meal dates

- 5 laboratory-confirmed cases

- PFGE-matching *Salmonella* Enteritidis

Case Summary

Onset dates:

October 27 – November 3

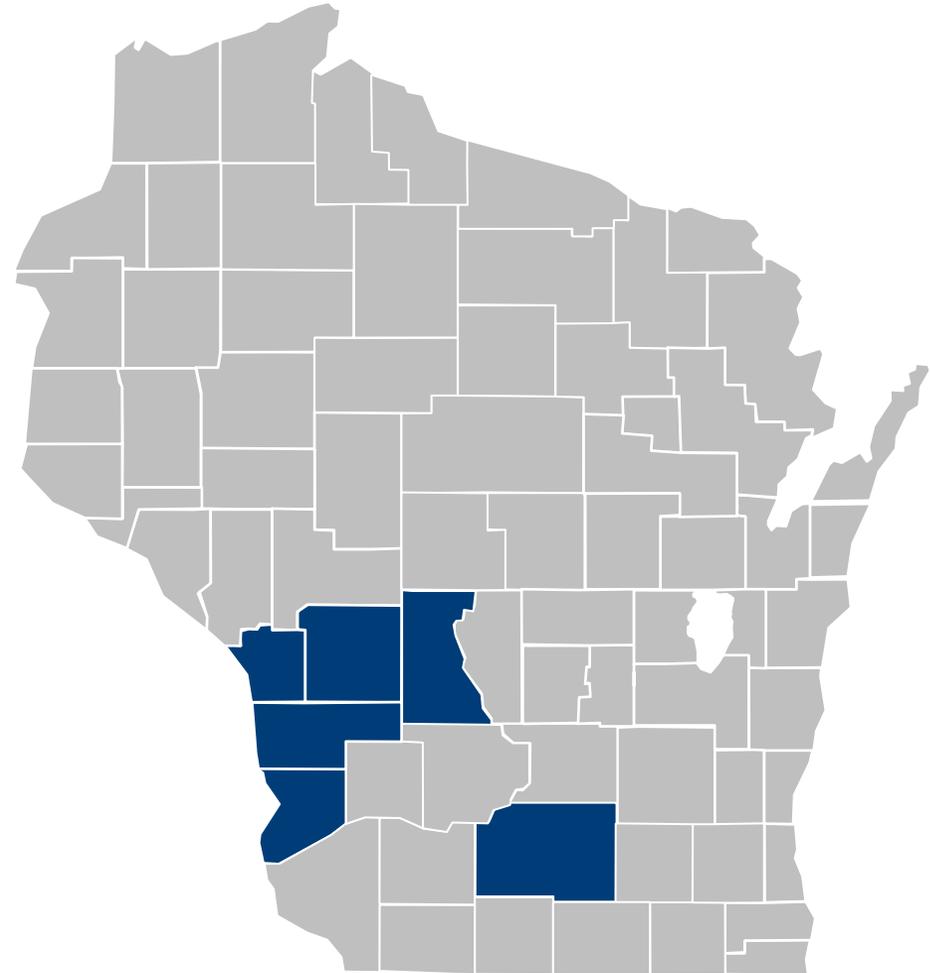
Mean age: 40 years

67% female

Residents from 6 counties

One hospitalization

Outpatient visits: seven patients



Reported Signs and Symptoms

Diarrhea



Body/muscle aches, fatigue



Abdominal cramps, nausea, sweats, chills



Fever



Vomiting



Epidemic Curve of Salmonellosis Cases

By Illness Onset and Meal Dates

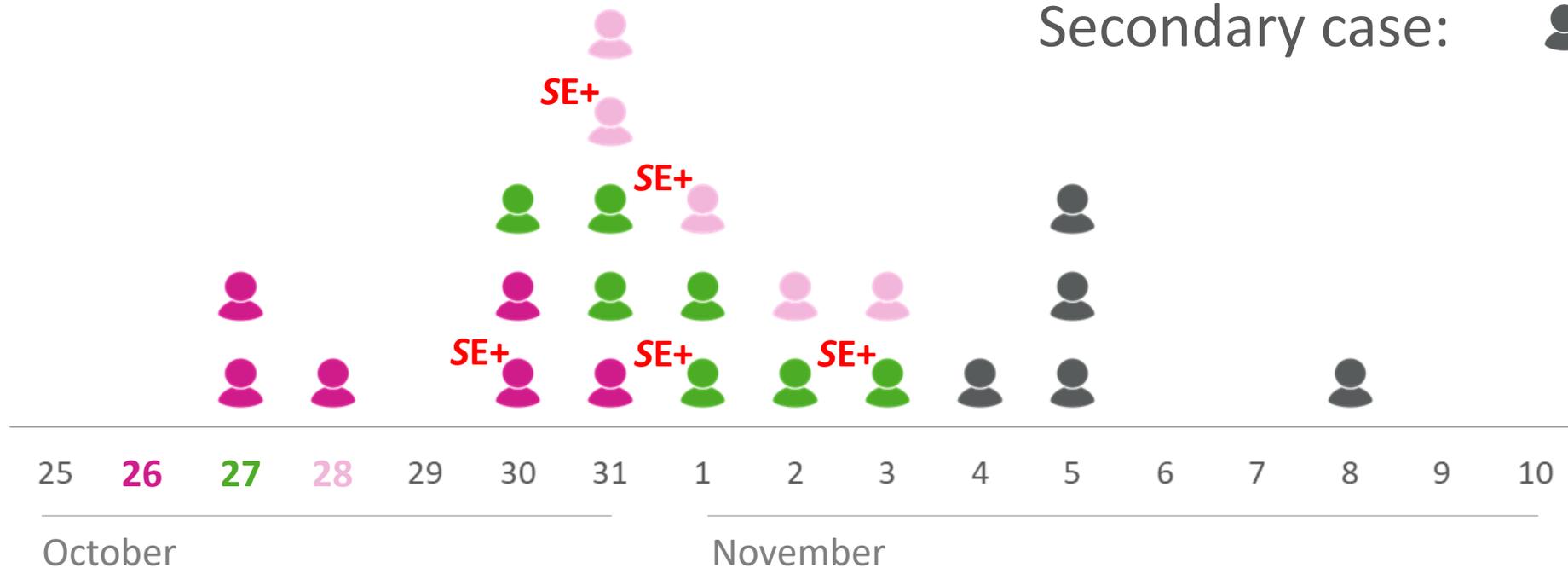
SE+: Culture positive for *Salmonella* Enteritidis

Meal date: **10/26** 

10/27 

10/28 

Secondary case: 



Case-Control Study

	Ill	Well
Ate chicken kabobs	15	7
Did not eat chicken kabobs	1	18

Odds ratio = 39.0
p-value <0.001



Case-Control Study

No other foods had a statistically significant association with developing illness.



Case-Control Study

Attack Rate Table

Food / Drinks: Case-Control Analysis	Persons who ATE foods				Persons who did NOT eat foods				Statistical Analysis: Univariate		
	Ill	Well	Total	%Ill	Ill	Well	Total	%Ill	OR	p-value	p-value type
Chicken kabob	15	7	22	68%	1	18	19	5%	38.6	<0.0001	Fisher's Exact
Shrimp kabob	15	17	32	47%	2	11	13	15%	4.9	0.088	FE
Beef kabob	15	19	34	44%	1	5	6	17%	3.9	0.373	FE
Vegetable medley	14	13	27	52%	3	9	12	25%	3.2	0.168	FE
Risotto croquette	13	16	29	45%	4	8	12	33%	1.6	0.729	FE
Crab cake	14	16	30	47%	3	10	13	23%	2.9	0.187	FE
Vegetables vol au vent	8	12	20	40%	9	12	21	43%	0.9	1.000	FE
Blueberry cheesecake	5	17	22	23%	12	8	20	60%	0.2	0.027	FE
Chocolate cake	9	14	23	39%	8	12	20	40%	1.0	1.000	FE
Apple Tart	8	9	17	47%	8	14	22	36%	1.6	0.531	FE
Cocktail	11	11	22	50%	6	15	21	29%	2.5	0.215	FE
Beer	6	3	9	67%	11	24	35	31%	4.4	0.068	FE
Wine	5	12	17	29%	12	14	26	46%	0.5	0.347	FE

Environmental Health Findings

Chicken kabob was the only food item that was prepared in quantity prior to the event and then served all three days of the event.

All other menu items were prepared during the day of service.



Preparation Method

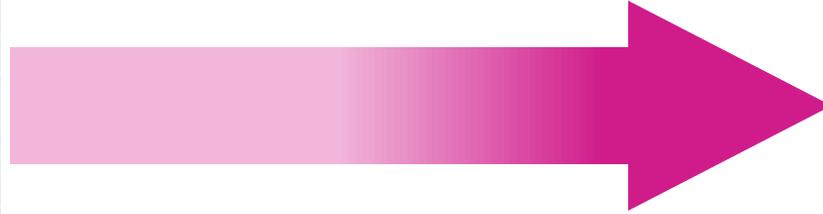
Chicken was prepared using an unapproved sous vide method that included a cook-chill-reheat process.

Sous vide requires a variance to the Wisconsin Food Code.

Variance requires demonstration of a kill step.



Implicated Food Preparation Method



Prep day 1

10/24

Whole chicken thighs brined in cooler

Prep day 2

10/25

Removed from brine
Vacuum packed
Sous vide 1.5 hours
Chilled in ice bath (in vacuum pack)

Meal 1

10/26

Chicken thighs cut in half and skewered

Grilled for marks

Baked on top of roasted vegetable medley in the oven

Temperatures were not taken throughout the preparation process

Meal 2

10/27

Meal 3

10/28

Interventions and Lessons Learned





Thank you!

Questions?

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